

Health Consultation

Belltown P-Patch
Seattle, King County, Washington

April 12, 2001

Prepared by
The Washington State Department of Health
under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry



Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond quickly to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

For additional information or questions regarding DOH, ATSDR or the contents of this health consultation, please call the health advisor who prepared this document:

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Glossary

Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.
Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short-term (acute) or long-term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
No apparent public health hazard	Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Risk	The probability that something will cause injury, linked with the potential severity of that injury. Risk is usually indicated by how many extra cancers may appear in a group of people who are exposed to a particular substance at a given concentration, in a particular pathway, and for a specified period of time. For example, a 1%, or 1 in 100 risk indicates that for 100 people who may be exposed, 1 person may experience cancer as a result of the exposure.
Route of exposure	The way in which a person may contact a chemical substance that includes ingestion, skin contact and breathing.

Background and Statement of issues

This health consultation was prepared at the request of the Washington State Department of Ecology (Ecology) to evaluate the potential health hazard posed by lead in soil to gardeners and consumers of produce at the Belltown P-Patch site located in Seattle, King County, Washington. DOH prepares health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

The Belltown P-Patch site is located at the intersection of Elliott Avenue and Vine Street in the Belltown neighborhood of downtown Seattle (Figure 1). The site is a community garden owned by the City of Seattle Department of Parks and Recreation, and managed by the Department of Neighborhoods. It is bordered on three sides by two roads and an alley. The fourth side borders three vacant historic cannery houses. About 40-50 adult gardeners from nearby apartments and condominiums use the P-patch, and children occasionally accompany adults.

Five lots were purchased to make up the P-Patch property totaling roughly 6000 ft². Four of the lots were purchased in the early 1990s, and analysis of soil samples at the time of purchase did not reveal any contamination of concern. The fifth lot, purchased in 1998, contained a large soil pile suspected to be contaminated with petroleum and lead products. In August 1999, the soil pile and underlying soil on the lot was dug up with a backhoe to an average depth of 3.5 ft, and 120 tons of contaminated soil were removed from the site. The horizontal extent of digging was limited due to existing gardens on the NE and SW sides of the excavation area. Analysis of soil samples taken in the bottom of the excavation pit confirmed that lead levels were below Ecology's residential cleanup standard of 250 ppm¹. Soil samples from the side walls of the pit, however, revealed lead levels as high as 620 ppm on the SW side wall, and 1770 ppm on the NE side wall².

In the fall of 1999, one dump truck (volume of dump bucket unknown) of sterilized fill was dumped into the excavated area. Then an additional 60 yds of topsoil from Cedar Grove Composting^a were dumped and spread on top of it. The topsoil layer was estimated to be one to two feet thick³.

Additional sampling was conducted in April 2000 along six transects that branched perpendicularly from the side walls of the former excavation pit (Figure 2). Two soil samples, both located 4.5 feet from the NE pit wall at a depth of 3 ft below the ground surface, were found to have elevated lead levels (410 and 728 ppm)⁴. All other samples were below the cleanup standard of 250 ppm (Table 2).

The source of lead contamination is uncertain, but reports of a cannery on-site in the past may be one potential source. A former gas station located nearby is thought to be the probable source of the petroleum and lead contaminated dirt pile.

^a Cedar Grove Composting is an organic recycling company that uses yard wastes to make nutrient-rich compost.

Table 1. Lead in soil in and around the excavation pit at Belltown P-Patch (August 1999)

# of Samples	Location Relative to Pit	Depth Below Ground Surface	Lead Concentration (ppm)
2	bottom of pit	42 inches	3 and 22
1	NE side wall	36 inches	<i>1770^a</i>
1	SW side wall	15 inches	<i>620</i>

^a **Bold and italicized values indicate soil levels that exceed the MTCA residential soil cleanup level**

Table 2. Lead in soil around the former excavation pit at Belltown P-Patch after clean fill and topsoil were added to the site (May 2000)

# of Samples	Location Relative to Former Pit	Depth Below Ground Surface	Depth of topsoil at sample point	Lead Concentration (ppm)
2	4.5 ft outside pit's NE side wall	36 inches	1.5 ft	<i>410, 728^b</i>
24	3 ft to 10 ft outside of pit's NE and SW side wall	3 to 5 feet	½ to 2 ft	ND to 92

ND - Not Detected (below method detection limit of 2 ppm)

^b **Bold and italicized values indicate soil levels that exceed the MTCA residential soil cleanup level**

Discussion

Elevated lead levels have been found in soil at the Belltown P-Patch property. The following discussion will address the exposure and potential health hazards associated with lead found at the P-Patch.

Lead is a naturally occurring element that is found at low levels in undisturbed soils. In the Puget Sound region of Washington State, the background soil lead concentration ranges between 5 and 30 ppm⁵.

Past uses of lead in paint, gasoline, plumbing, pesticides and canning have contributed to wide spread dispersion of lead and subsequent human exposure. Elimination of lead in gasoline and solder used in canning has greatly reduced exposure to lead through inhalation and ingestion pathways. As a result, the number of one to 5-year-old children in the U.S. with elevated blood lead levels has dropped from 88.2% in the late 1970s, to 4.4% in the early 1990s⁶. Currently, the main pathways of lead exposure in children are ingestion of paint chips, contaminated soil and house dust, and drinking water in homes with old plumbing.

Lead causes a wide array of health effects in different systems of the body, but the primary target is the nervous system. Children less than seven years old are more susceptible to lead exposure

and more sensitive to its toxicity than adults. Health effects include decreased IQ, decreased attention span, and irritability.⁷ Some of these effects have been seen in children with blood lead levels as low as 6 micrograms per deciliter (µg/dl). The CDC considers a level of 10 µg/dl or more to be an indication of excessive lead exposure.

On the P-Patch site, one potential source of lead exposure is inadvertent soil ingestion after direct contact with contaminated soil or inadvertent ingestion of soil adhering to edible portions of vegetables. Soil lead levels in the top few inches of the ground surface, where humans are most likely to come into direct contact with soil, are unknown because soil lead concentrations are reported only for depths of 3 ft or greater. However, since the supplier of the topsoil (Cedar Grove Composting) must meet quality standards in order to sell their product, it can be assumed that data presented in their annual Compost Quality Summary is a reasonable estimate of top soil lead concentration. The maximum allowable lead level in compost is 150 ppm and actual measurements in March and September 2000 are less than 67 ppm⁸. These levels, by comparison, are much lower than the MTCA residential soil cleanup level of 250 ppm. Soil lead levels below this are not considered to significantly contribute to adverse health effects in humans.

Root uptake of lead by vegetable plants and subsequent ingestion by humans is another potential source of lead exposure. There is sparse evidence that root crops such as carrots might absorb more lead than previously thought⁹, but the majority of vegetables absorb very low quantities of lead from soil. High organic content in soil, as is the case at the Belltown P-Patch, further prevents lead from being absorbed by plants because organic materials bind metals making them less available for uptake.¹⁰ Furthermore, it is unlikely that vegetable roots are contacting contaminated soil. The depth of most vegetable roots is less than 12 inches into the soil.¹¹ Based on soil sampling logs from the site, the Cedar Grove Composting topsoil overlying the contaminated sites is about 18 inches deep, and there is reportedly another one-foot layer of “clean” soil beneath the topsoil, therefore vegetables are not rooted in contaminated soil.

The possibility exists for bringing subsurface contaminated soil to the surface over time through repeated tilling or turning of the soil while planting and harvesting. This concern is minimal, however, because the City of Seattle Department of Parks and Recreation is planning to remove the remaining contaminated soil in November 2001.¹²

Children’s Exposure to Lead / Child Health Initiative

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults when faced with contamination of air, water, soil, or food¹³. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter and their breathing zone is closer to the ground, resulting in a greater likelihood to breathe dust, soil, and heavy vapors.
- Children are smaller and receive higher doses of chemical exposure per body weight.
- Children’s developing body systems are more vulnerable to toxic exposures, especially during critical growth stages in which permanent damage may be incurred.

In the case of the Belltown P-patch, however, children are not exposed to lead in soil or produce for reasons mentioned in the preceding section.

Conclusions

No apparent public health hazard exists for children and adults exposed to soil and produce from the Belltown P-patch. Though some subsurface soil lead concentrations are elevated to levels of concern, the addition of “clean” fill and topsoil to the site prevents exposure both by direct contact, and root uptake of vegetables. Furthermore, the City of Seattle plans to excavate soils to a wider area than previous efforts and will eliminate the potential for lead contaminated soils to be tilled to the surface.

Recommendations / Public Health Action Plan

Since remediation of the site is going to occur in November 2001, the following recommendations are intended for the users of the site from now until that remediation occurs.

- Avoid planting root crops (e.g., carrots). If gardeners do plant root crops, they should clean and peel them before eating.
- Avoid tilling, and digging beyond 12 inches.
- Thoroughly wash produce before eating.

If soil removal does not occur, then it is possible for lead-contaminated subsurface soil to mix with topsoil due to repeated digging or turning of the soil. The previous and following recommendations apply in the event that soil remediation does not occur.

- Sample soil from the root zone (0-12 inches) and analyze for lead.
- Sample vegetables and analyze for lead.
- Maintain soil pH > 6.5.
- Maintain high organic content in soil.

Action

DOH is available to evaluate future sampling data gathered from this site.

Preparer of Report

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Appendix

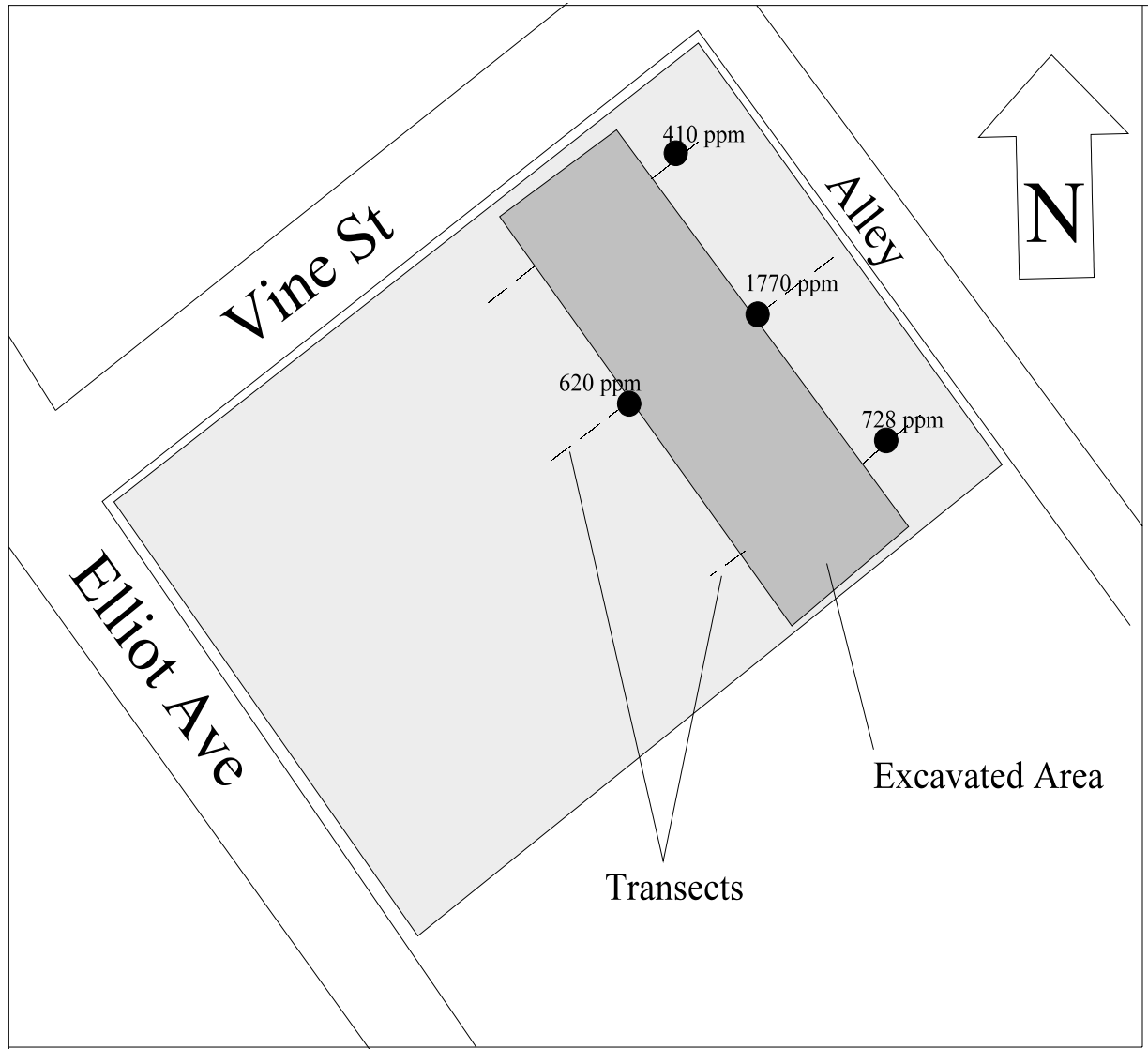
Figure 1 - Site location map for the Belltown P-Patch site, Seattle, Washington

Figure 2 - Approximate location of sample transects and elevated lead in soil samples at Belltown P-patch.

Figure 1. Site location map for the Belltown P-Patch site, Seattle, Washington



Figure 2. Approximate location of sample transects and elevated lead in soil samples at Belltown P-patch.



Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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